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INTERACTIVE VIDEO TRAINING SYSTEMS (IFTS):

FRUITFUL GROUND FOR AIR FORCE EXPLORATION?

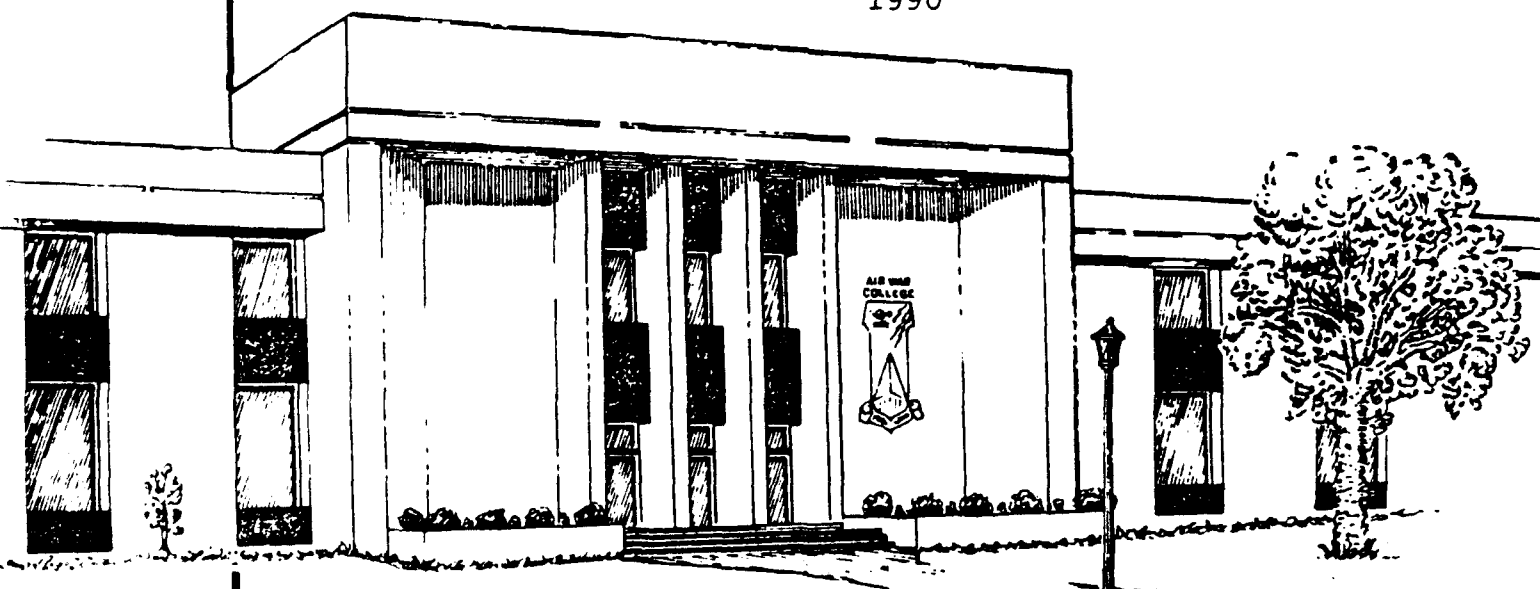
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1990



AIR UNIVERSITY
UNITED STATES AIR FORCE
MAXWELL AIR FORCE BASE, ALABAMA

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INTERACTIVE VIDEO TRAINING SYSTEMS (IVTS):
FRUITFUL GROUND FOR AIR FORCE EXPLORATION?

by

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A DEFENSE ANALYTICAL STUDY SUBMITTED TO THE FACULTY

IN

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Executive Summary

TITLE: Interactive Videodisc Training Systems (IVTS): Fruitful Ground For Air Force Exploration? **AUTHOR:** Chandler D. Mapes, Lieutenant Colonel, USAF

Although computers have been used for conducting training for more than ten years, the IVTS technology (which uses a totally interactive format with the trainee) is a comparatively new one. Much of the commercial world is moving in the direction of IVTS for their training needs because evidence has shown trainees using IVTS learn their tasks faster, retain the knowledge longer, and the training can be conducted less expensively over the long term. The Air Force has taken a fragmented approach thus far in exploiting the IVTS technology as an Air Force-wide effort. Available IVTS technology, coupled with expected technological advances in the IVTS area, offer great potential in the future as Air Force training dollars dwindle. The Air Force can exploit that potential best through a centralized funding/implementation/management approach at Air Staff and Major Command levels.

Biographical Sketch

Lieutenant Colonel Chandler D. Mapes (BA Rutgers' University, MS University of Southern California) is a career officer in the Communications-Computer Systems career field. His assignments have included Headquarters Pacific Air Forces, Headquarters Air Force Communications Command, Headquarters United States Air Force (where he worked functional management of the Communications-Computer Systems Officer and Enlisted career fields), and base level assignments in communications units in Texas and the United Kingdom (as a Communications Squadron Commander). He is a graduate of Squadron Officer School, Air Command and Staff College, Armed Forces Staff College, and the National Security Management Course.

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Chapter I

Introduction

The ability to use computers in the training world has been available for more than ten years. The advent of desktop computers enhanced that capability greatly, and the development of "user friendly" software for use on these desktops aided still further. The combination culminated in a system which was easily adaptable to satisfying training needs across a wide spectrum. The resulting industry has been dubbed "computer-based training" (CBT) and is just now being refined.

Initially, the costs of hardware (the machines and ancillary equipment) and courseware development (the software which allowed the machine to interact with trainees in a particular subject) were very high. In addition, there was tremendous uncertainty about the benefits of using this new technology. It is not hard to imagine, then, the hesitancy with which many managers within government and industry initially approached computer-based training (25:58).

Today, however, there is heightened awareness of how effective these systems can be, especially with the advent of computer-based systems using

an interactive videodisc (IVD) format. They have cut costs and opened a whole new world of potential applications for trainers (25:58) which is being exploited by industry and by the Department of Defense (particularly the United States Army). The Air Force has been slow to attack the technology in an organized way, and there may be benefits which are not being realized in terms of cost savings, especially in terms of enhanced training effectiveness.

Statement of the Problem

Although there is ample evidence that computer-based training, particularly the subset known as Interactive Videodisc (IVD) training, is a very efficient means of improving an individual trainee's absorption and retention of training material, the Air Force has been slow to explore the possibilities. There are numerous individual efforts being addressed across the Air Force; several of these will be looked at and assessed. The problem to be explored here, however, is: Will an overall Air Force-wide approach to centrally and systematically exploit the IVD technology allow the Air Force to reap better benefits in the future for all Air Force commands?

Purpose of the Study

The purpose of this study was to assess the computer-based training technology and how the Air Force should be using this technology to improve their training. In doing that, the study assessed what kinds of capabilities are available, how commercial industry is applying some of those capabilities to improve their training, what the Army and the Navy are doing in the area, and some examples of how the Air Force is implementing IVD projects. The study examined the results of recent studies addressing IVD training and extrapolated from those studies to make several recommendations as to how the Air Force can better take advantage of this new technology in some fertile training areas.

Definition of Terms

Due to the number of terms which need to be explained a glossary of terms has been provided at page 32.

Importance of the Study

With continuing increases in training costs and likely budget cuts in the future, trainers and training managers must take innovative new approaches

to get more "training bang for the training buck." There is the likelihood that Interactive Videodisc Training Systems (IVTS) can offer some innovative approaches in improved training, reduced training time, and potentially lower long-term costs. It is essential that their capabilities be carefully scrutinized and, if deemed to be valuable, that an integrated development effort commence to take full advantage of the benefits.

Chapter II

Interactive Videodisc Training Systems (IVTS)

Components

The components of an IVTS include a micro-computer, high resolution video monitor, a videodisc player (usually laser), and some sort of interface device (25:58). The interface device could consist of a touch-sensitive screen, a "mouse", a lightpen (which is used to illuminate, or "key", sections of the screen), a "joystick" (popular with home computer games), or even a keyboard panel. Operating courseware includes floppy diskettes and a 12-inch videodisc. The computer controls the instructional dialogue, routes the students through different instructional paths depending on the way they respond to questions, controls the audio-visual display, and provides the computerized record keeping (25:58). The twelve-inch videodisc is the key to the action and can provide a variety of media such as slides, diagrams, motion video, or digital data in various combinations. Two audio tracks can produce sound in stereo or give the course in two separate languages. A system as described here will generally cost between \$4,500 and \$8,000 (29:3).

The "courseware" is the umbrella term both for the course information contained on the diskettes and the IVD and the diskettes (or discs) themselves. The courseware usually requires extensive development. However, the difficulty (and time involved) with the development of the courseware is in direct relation to the complexity of the material which is to be trained. It is safe to say that the design time for the courseware for a course aimed at teaching receptionists would be significantly shorter than for a course associated with nuclear physics.

Although it is beyond the scope of this study, there is also extensive use of larger computers in both computer generated imagery (CGI) and simulators. These will be addressed briefly in Chapter III in the discussion of current usages of the technology in the Department of Defense.

Benefits of IVTS--The Evidence

As with any new technology, there are claims of success to varying degrees in the use of IVTS. The claim which tends to be the most prevalent is that IVTS significantly reduces training time and increases retention. Some experts state that IVTS can cut training time in half (12:18), while others cite surveys that reveal that learning a specific task using IVTS may take anywhere from 25 to 50 percent less time than with traditional methods of instruction (25:58).

A definitive source of information regarding IVTS is the Report To Congress on the Potential of Interactive Videodisc Technology For Defense Training and Education, published in January 1989 and distributed in summer 1989. In this study, thirty-one other studies were included (15 concerned military training, 3 concerned industrial training, and 13 concerned higher headquarters applications) (29.iii). The study insightfully points out some driving reasons which make the use of IVTS desirable. First, a shrinking population of 18 year olds dictates that we make the most out of what is available to us. Second, increases in the number of military systems compound training problems. Third, the growing technological complexity of military jobs challenges the training resource. Fourth, rising training costs demand better management of a limited resource. Fifth, as the usage of National Guard and Reserve forces increases and our dependency on them grows, IVTS offers a way to maximize both training time and productivity (29.2). These reasons for exploring IVTS are compelling and are made more compelling when looking at the results of the study.

The study validated the positive effects of IVTS across the board. When compared to conventional approaches to instruction, results showed that IVTS can raise a student from the 50th percentile to the 82nd percentile (29.23). Findings also showed that increases in the interactive features of the technology yielded greater training improvements and that IVTS using IVD technology was

more effective than simple Computer Based Instruction (CBI), which uses only text and questions written on the screen and asks for multiple-choice response selections from the trainee. Additionally, directed, tutorial approaches were found to be more effective than freeplay simulations (29:23). They found IVTS to be relatively more effective in higher education situations than in military training, however this was due to the fact that military training looks for some threshold of achievement at minimum cost while higher education applications seek to start with a fixed cost and look for maximum achievement (29:25). Finally, findings indicated that IVTS enhanced both knowledge and skill training, with a rise from the 50th percentile to the 72nd percentile in knowledge tests, and a rise from the 50th percentile to the 65th percentile in performance tests (29:25). The results did not show any significant increases in knowledge or skill retention.

Commercial industry has significant training requirements which have led them to explore IVTS with good results. Experts estimate that the \$30 billion that U.S. businesses spend on education and training each year will rise by 5 percent each year through 1992 and that the approximately 2 percent of the training currently performed using IVTS will rise to about 8 percent (12:20). A 1984 IBM study showed IVTS to be about three times more effective than an instructor and that even simple computer based instruction teaches one third faster than standard classes using an instructor (12:20). In fact, IBM has over

3,000 IVD workstations currently installed for training.

Federal Express Corporation has installed 1,300 interactive workstations to provide training to its 6,000 customer service and 17,000 courier personnel. Federal Express studies have shown 30% reduction in employee errors and a 60% reduction in training time when using IVD training techniques (40:1). Xerox has been one of the leaders in using IVTS, claiming to save \$6 million each year training its 15,000 field-service technicians this way. Xerox's training program teaches everything from computer basics to repairing local area networks and allows users to work at their own pace. Initial investment included about \$1 million for the software plus \$3 million for hardware (500 desktop stations in 140 training centers and customer service sites around the U.S.) but has yielded big dividends. Xerox has estimated that they save about \$300-\$600 per trainee each day. They have reduced training time by 30 percent and have increased their learning rate by 40 percent (12:20). Eastman Kodak, E. I. Du Pont de Nemours Company, and the Ford Motor Company have also found benefits in the use of IVD training (40:2).

The literature clearly shows that IVTS has advantages. The next chapter will address some ways that the military is applying the technology.

At this point, however, as part of the discussion on benefits, there are two significant military advantages which make the use of IVTS particularly attractive. They both revolve around the incredible expense of new,

sophisticated military equipment.

The first is just that, modern military equipment is expensive. Subjecting expensive equipment to the excessive wear and tear of continuous usage in training and the risk of mishandling by trainees during that training raises costs (22:46). It is necessary to find ways to minimize those costs and simulation techniques, made possible by IVTS, offer fertile possibilities.

The second advantage of IVTS from a military perspective is a corollary of the expense equation and involves availability. Quite simply, a lot of military equipment, because of its expense, is a "one of a kind" piece of equipment on a military installation. Such equipment is necessary for military operations to continue and cannot be made available for training. There are endless examples of these types of equipment on a typical Air Force base. They include air traffic control radars and navigational aids such as the Instrument Landing System. When weather is bad, it is absolutely impossible to take critical "one-of-a-kind" equipments off the air so training can take place. IVTS can offer potential "surrogates" in the form of simulations that are cheaper and have less impact on operations and safety. In the case of airplanes, which are not "one of a kind" items on Air Force bases, availability from an operational perspective is what drives a training manager in the direction of IVTS, i.e. airplanes need to be performing operational missions and are not easily made available for training. The next chapter will address some practical applications and look at how some military trainers have already taken advantage of the technology.

Chapter III

What's Going On?

Throughout the Department of Defense, there are numerous initiatives underway in the area of Interactive Video Training, but they are fragmented. The Army was one of the first to get serious about IVTS. Their use of an IVTS for TOW antitank missile training showed great success and they realized the immediate benefits of the technology. This early interest helped pave the way for their EIDS system.

EIDS or "Electronic Information Delivery System", is a "foot-in-the-door" kind of approach to the IVTS revolution. The system consists of a videodisc player, a micro computer, a TV monitor, and various input/output devices. Operating essentially as discussed in the last Chapter, the videodisc can store up to 54,000 video still frames on each side and offer instruction in the form of a 30-minute, full-motion video program, a 60-plus-hour audio instruction program, or a digital text format that allows storage of more than 800,000 pages (26:13). The concept, rather than the hardware, is the most important point -- a major service has chosen to get in on the ground floor of the technology in a big way (Army wide), with significant investment costs

(around \$200 Million), using a system that will be standard throughout the Army and be available to the Reserve and National Guard components. By selecting standard hardware and software and fielding it, the Army is providing a valuable building block from which future training can be built.

In addition to the EIDS, the Army is taking advantage of what the technology offers in other ways. High-tech simulators have decreased costs and increased training availability and effectiveness in the areas of armored vehicles, small arms training and other target range requirements, electronic countermeasures and many other areas (22:46-58). The use of these systems continues the validation of the idea that simulations must be thought about when the alternative is training on expensive, limited military hardware.

The Navy has recognized the use of IVTS training and claims students using IVTS retain four times as much material as those who use traditional, lecture-style courses (23:158). One initial application has been the use of IVD for language training at the U.S. Naval Academy which has effectively increased listening comprehension in less time (23:159). The Navy has looked at the "paperless ship" possibility, using IVD technology to store the records, manuals, and files which occupy a tremendous amount of space and add significant weight to our fighting ships. Such a shipboard IVD system could double as a training system, providing valuable training at sea which heretofore had to be provided ashore (23:160). The Navy has also produced a

videodisc course for training medical corpsmen in field medicine trauma care (25:59).

In the Air Force, there have been pockets of innovative activity. Significant among these are efforts in Tactical Air Command (TAC), Strategic Air Command (SAC), Air Force Communications Command (AFCC), the Air Force Academy, Air Training Command (ATC), and recently, Military Airlift Command (MAC).

TAC, under the auspices of the 4400 Maintenance Training Flight (MTF) at Hill AFB, Utah, has been the Air Force leader in applying IVD technology to the training problem for the Tactical Air Forces (TAF) which also include Pacific Air Forces (PACAF), United States Air Forces in Europe (USAFE), and Alaskan Air Command (AAC). They have developed more than 10 courses, predominantly involving the F-15/F-16 aircraft and estimate that more than 50 more courses will be available in the next several years (32:1-3). Their courses are designed to reinforce or augment formal Air Training Command (ATC) technical training (the initial training an Airman receives at a Technical Training Center prior to being sent to the field to actually work on his particular piece of equipment). The TAC concept is not designed to provide basic job skills training to three level (junior) technicians, but is better suited for five and seven level technicians (more senior people with greater than 3 years in service) who are already familiar with the weapon system (30:1).

TAC uses IVD courseware in conjunction with hands-on training derived from a conventional on-the-job (OJT) training program. They therefore are providing the IVD courses as a continuation training program which provides the chance for technicians to develop the skills and acquire the knowledge required to function in technologically advanced work environments demanded by complex weapon systems (31:3). They have moved to IVD for a variety of reasons, among them being the incredible expense of the assets involved (airplanes in this case) and their availability for use in training, their inherent complexity, the lack of enough qualified instructors to use traditional teaching methods, and because it enhances existing training and leads to "performance with understanding." They have standardized the hardware for the TAF by using the Sony VIEW (SMC 2000 or SMC 3000) and the QUEST Expert Authoring System (33:2) and have concentrated on areas which have the greatest payback for the TAF in terms of numbers of technicians. TAC projects by 1993 they will have about 150 hardware systems around the command for the F-15 and about 150 for the F-16 (30:7-9).

Strategic Air Command (SAC) uses the 436th Strategic Training Squadron at Carswell AFB, Texas to do their IVD training development. They have concentrated entirely on systems for maintenance technicians for the B-1B, have six IVD courses on line, and have more than 50 courses projected to be available over the next several years (34:1). They use the WICAT computer

system with the WISE authoring system and plan for about 80 hardware systems around the command over the next several years.

The Air Force Academy, in their Language Learning Center, has been a trendsetter in the IVD world as well. Involved with the technology since 1983, they now use in-house developed IVD programs (using the SONY system) to teach seven languages over a 32-terminal system. They plan to add 32 more terminals in mid-1990 because of the outstanding results (41).

Air Training Command is actively involved in IVD implementation efforts at Chanute AFB (with the Ballistic Missile Instructional System, using Z-248s, OASIS software, and other Panasonic equipment), at Goodfellow AFB with the Sentinel Bright II program (using laser film), and at Keesler AFB with the Administrative Officers' Course. Other IVD efforts in ATC include Health Care Science and Advanced Trauma Life Support (42). ATC intends to offer a CBI Development Course at Sheppard AFB by 1991. In an effort to continue to bring the Air Force into the mainstream of IVD development, ATC (along with the Air Staff) is reworking several key Air Force 50-Series publications to include IVD information: Air Force Manual 50-2 (Instructional Systems Development) and Air Force Regulation 50-8 (Policy and Guidance for ISD Development). They are also developing an "Interactive Courseware Developer's Guide" as part of the Air Force Pamphlet 50-58 Series (Handbook for Designers of Instructional Systems) (43).

Military Airlift Command (MAC) is just getting started in the IVD business and plans to buy 250 hardware stations for use throughout the command in the 1992-1997 timeframe. They want to use the MERLIN system for their courseware.

AFCC has been another leader in the field of Air Force IVTS and one of the earlier beneficiaries of the technology. As the owner and maintainer of a significant amount of the "one-of-a-kind" equipment discussed in Chapter II, AFCC was a logical innovator in the IVTS field.

An example of early IVTS innovation was the system developed by the 1872nd School Squadron (AFCC) located at Keesler AFB, Mississippi in the early 1980's to coincide with the fielding of the GPN-22 Precision Approach Radar (PAR). The GPN-22 is an extremely expensive (over \$4M) phased array radar designed to allow Air Traffic Controllers to "talk down" pilots operating aircraft in bad weather minimums belows ceilings of several hundred feet and visibility of 200 feet. It is an especially valuable piece of gear for the Air Force, particularly at locations where the weather is bad for a significant part of the year as in the European theater of operations. It is also a very dependable radar with an "up time", or in-commission rate, well over 90%. This is a great statistic for a flying wing commander to see, however it portends training difficulties for the Communications Squadron which is charged with maintaining the radar and with training future radar

maintenance technicians. When can the radar maintenance technicians take the equipment off the air to perform necessary training functions? The answer is--RARELY! Young airmen are forced to perform training on the midnight shift and on weekends when the wing has no sorties scheduled. That, in itself, is a limitation, but coupled with the value of the equipment, leads one quickly to considering the use of IVTS to fill in the gaps. The 1872nd School Squadron's IVTS was a monumental success when, after 3-4 years of intense development (including one "back-to-square-one" scenario), it was fielded in August of 1987.

AFCC bought almost 150 pieces of SONY hardware to operate the system within the command, and this hardware is serving as the first building block in expanding the IVTS capability.

To begin with, the GPN-22 IVTS system allows radar maintenance trainers the chance to insure their airmen are well versed in the basics of the system before turning them loose on the prime equipment. This keeps the mission from being affected by taking a key piece of equipment off the air more often than necessary and also builds better confidence among young maintenance technicians who do not want to be responsible for damaging a valuable mission-critical radar.

It is a "no lose" situation, and the 1872nd School Squadron (as AFCC's training development arm) is seeking to build upon this success. They

have already developed an IVTS Flight Check Program for the GRN-29 Solid State Instrument Landing System (SSILS) in 1987, as well as three other SSILS IVTS programs to be released in early 1990. The SSILS is a high value, flight oriented, landing aid similar to the GPN-22 and similar benefits are expected. They have also developed a generic IVTS for the Spectrum Analyzer (a common piece of communications maintenance equipment) and have several programs that deal with a Spectrum Analyzer for satellite systems scheduled for release in 1990. An IVTS dealing with the use of the Oscilloscope rounds out the trend setting of the 1872nd School Squadron and should also be fielded in 1990. The areas in which they continue to excel are those involving "one-of-a-kind", high cost equipment, as well as equipment cutting across the spectrum of communications maintenance technical requirements. It is a very logical strategy which has high (yet somewhat intangible) paybacks.

HQ USAF/LE, as the manager for most Air Force maintenance technicians, provides a useful forum for training managers from all the MAJCOMs to get together and compare notes in the MATAG (Maintenance Training Advisory Group). The formation of the Communications-Electronics MATAG Working Group has highlighted communications maintenance specialties for particular emphasis and provides an avenue for valuable crossfeed across the MAJCOMs.

The Air Staff, through the MATAG Working Group, is implementing an

initiative which can potentially be a tremendous "foot in the door" for IVD.

This idea will, for the first time, use commercial, off-the-shelf IVD courseware as part of the Career Development Courses (CDCs) which new communications maintenance technicians must take to get upgraded in their particular specialty (36:2). The IVD portion of the course will deal with Basic Electronics and will be usable in many of the communications maintenance specialties.

The potential for application of this approach to other training offered by Extension Course Institute (ECI) is unmistakable. ECI supports the dual-channel system of the Air Force on-the-job training program by providing the text-study portion, which Airmen must complete successfully in order to progress in their particular specialty (37:2-3). ECI offers courses in more than 40 career field areas in the Air Force. The increased use of IVTS in this application will be considered in Chapter V.

Chapter IV

Where To Next?

The future portends more fertile ground in which to plow the educational aspects of Interactive Video. In the July 1979 issue of Video magazine ("Inventing the Hyperdisc") (5:53), a dichotomy between computer afficianados and video producers is briefly discussed. The full merge of the technologies is termed as "Hypermedia", but the key catalytic event that will allow this to happen has not yet occurred. The computer people see video as an "add-on" function much like the word processing capabilities of a computer. Compact Disc-Interactive or "CD-I" is potentially going to provide the ground of compromise. CD-I is an extension of CD-ROM (Compact Disc-Read Only Memory) technology and is designed to combine full motion visuals, color still frames, graphics, text, and multiple levels of audio from monaural to stereo.

Taking the technology to its conclusion (at least as seen from the present time) leads one to what is called "Digital Video Interactive" (DVI). The DVI technology (introduced by General Electric in 1987) combines motion video, still pictures, multitrack audio, and computer graphics in a

single, integrated environment controlled by a personal computer. Current IVD systems can provide a similar capability, but there are some basic differences. Current systems use videodiscs as the source of video and audio material; as you make choices, the head jumps to a different track which contains a simulation of the result. Drawbacks include: limited number of pre-designed choices; annoying interruptions as the laser disk head moves around on the disk; and the requirement for additional computer graphics software and hardware to superimpose either text or computer generated graphics onto the original video image (1:283). DVI gets around these limitations by storing and processing everything as digital data. Advanced techniques provide for the "compression" of the video data which will allow more than an hour of full screen motion video and multichannel audio on a single CD-ROM disk--all of which can be played back in real time. Uncompressed data would have filled the disk in 96 seconds (1:283). The tools for cutting through some of the complexity in constructing courseware will be available, and the process will be greatly simplified.

At the far end of the training spectrum is the possibility of linking hundreds or thousands of simulators in a global or area network and conducting large scale exercises (27:39). The costs would be prohibitive now, but as technology progresses, who knows what can happen? Already

we are seeing Interactive Television where viewers can play game shows from home and change camera angles on sporting events (2:70, 7:46). We see three dimensional scientific visualization techniques being made available on "multimedia" workstations (3:280). We even see Computer Generated Imagery and "image processing at such a high level of efficiency that surgeons can create computer-animated, 3-D images of their patients insides long before they pick up a scalpel, which reduces the danger in operations (21:142). Computer memory prices are about one thirtieth of what they were in 1980 and a standard \$4000 personal computer of today (with \$3000 worth of software and peripherals) can outperform the \$100,000 graphics workstation of 1980 (21:143).

These type leaps in technology will provide the capability to drive future training costs down, but the Air Force must begin to plan now how to best exploit them. The Air Force has been involved with complex simulators for years and is involved with CGI in F-16 weapons training simulators, E3A navigation function simulators, and a host of other simulators and computer aided trainers at Luke Air Force Base, Arizona (TAC). Detachment 1, 4444th Operations Squadron has been able to develop sophisticated trainers at about 10-20% of the commercial cost (24:50). The Air Force in-house IVD developers mentioned in Chapter III provide savings over commercial courseware as well. The capability therefore, is

there to be further explored, it just takes the right push, for the right reason. The funding and manpower profiles in the years ahead will provide the reason. The following chapter will look at how the "push" can be applied.

Chapter V

Summing Up

Summary

It has been clearly shown that IVTS offers significant advantages over traditional means of training in a variety of ways. First, students tend to learn tasks faster and retain them longer. Second, IVTS systems can be made to simulate the characteristics of expensive, technologically advanced, military equipment, and the IVTS systems can be made available for use in training more easily and cheaply than the mission critical military systems they simulate. Third, IVTS systems can provide these capabilities at lower costs in manpower and equipment after the significant "start-up" investment costs are incurred.

So what happens next? The IVTS technology is currently available and is almost certain to be refined in the years ahead as the technological evolution of IVTS continues. The need exists now as well and will also evolve over those

same years to be even greater than it is today.

Conclusions

Should the Air Force systematically and centrally choose to exploit the IVTS technology? The evidence seems to show that they have no choice in the long term if they are to be able to effectively train the numbers of quality technicians which will be required in the future.

As the defense budget is drawn down because of the Gramm-Rudman reductions, training funds will become even scarcer. Military personnel reductions are already planned and more are likely in light of Warsaw Pact restructurings. That implies that trained technicians will be at a higher premium than they are today and new ideas need to be explored harder than ever in the training area.

Logic would say that the Air Force would already have a well organized plan to take advantage of available technology to solve a growing problem. They do not. As stated earlier, there are fragmentary pockets of IVD initiative throughout the Air Force but no centralized thrust. In addition, as pointed out in Chapter III, three systems of hardware and software are being used by various MAJCOMs which hinders interoperability of design. Clearly something needs to be done to establish order, but what, and by whom?

The following section will address some actions which may be useful at various levels in the Air Force to begin the "institutionalization" of IVTS.

Recommendations

Air Staff Recommendations

The Air Staff is essentially a funding and guidance-giving enterprise for the rest of the Air Force, and it is in this area where they can help the most in IVTS implementation. For example:

1-The Air Force should use a standard hardware and software system for the use of IVTS. Allowing the MAJCOMs the ability to choose their own will only cause a mishmash of interoperability problems in the future. This situation is being actively worked by the Office of the Assistant Chief of Staff, Systems for Command, Control, Communications and Computers, Visual Information Group (HQ USAF/SCV) and is close to resolution. They expect a selection of a standard hardware/software system within CY 1990.

2-Establish an appropriate framework in the Air Force for IVTS advocacy. There are currently organizational impediments to IVTS cohesion. For example, as stated earlier, the Air Staff agency working hard to establish an Air Force standard hardware/software system is the Visual Information Group, which falls under HQ USAF/SC. This Group is also the Air Staff "spokesman" for the Aerospace Audiovisual Service (AAVS) which is an agency (falling under MAC) that has detachments throughout the Air Force that provide audio-visual support at the local level. The detachments also provide IVTS support to the

appropriate MAJCOM IVD training development unit in the way of pre-master video production. With the Air Force requirement being 861 IVD courses (and over 3500 hardware systems) to be produced (39:3) in FY 90-94, and AAVS manpower cuts of 16% from 1988 totals (38:1), the Air Force is moving in the wrong direction if they are to be able to satisfy future requirements.

The Air Staff activity currently "driving" the IVD requirement is HQ USAF/LE (Deputy Chief of Staff for Logistics and Engineering) and they are concentrating on the maintenance AFSCs they manage and are being aggressive and innovative in doing it. However, the overall spokesman for training is HQ USAF/DP (Deputy Chief of Staff for Personnel) who acts as the staff point of contact for Air Training Command who provides all the initial technical training for the Air Force. ECI, on the other hand, falls under Air University, which further expands the frame of reference for understanding the entire training equation.

A part of the "fix" is to establish an IVD Management Group, chaired by a general officer, made up of representatives from all the involved activities (HQ USAF/DP/SC/LE, AAVS, MAJCOMs etc.) who would address MAJCOM inputs and assemble a prioritization of AF-wide IVD requirements, present and future. An IVD Advisory Group was set up at Air Staff in 1985 but did not have a substantive charter. Immediate operational requirements obviously should be considered first, and projects currently being worked should be given priority.

Agencies fielding or intending to field new systems should be directed to include IVTS as requirements passed to contractors working the system to be provided to the Air Force when the system is fielded. All AFSC functional managers should be directed to consider (in conjunction with ATC, ECI, and IVTS experts) what in their career field looks like potentially fertile areas in which to inject IVD efforts in the future. These reports should be provided to the IVD Management Group who would reprioritize them and make them part of an overall Air Force plan. The plan should then be costed with MAJCOMs funding what they can in the operational area. The remainder should be put together as a POM (Program Objective Memorandum) input or a series of prioritized POM inputs to be considered with the overall Air Force POM. This is perhaps an oversimplification, but some variation of this proposal seems to be necessary if the advocacy and "visibility" for IVTS is ever to be sorted out. The alternative is continued fragmentation with individual IVTS initiatives being "hidden" in individual MAJCOM plans.

3-Educate the Air Staff and MAJCOM senior leadership to the potential of IVTS, and show them the 15-40% dollar savings which can be realized by doing IVD production in-house versus contracting it out (as most is now) (38:2).

There is such an education process (briefing team) planned for CY 1990, but it needs to happen fast if the senior decision makers are to be sensitized in enough time to turn around planned manpower cuts in AAVS and to elicit their

support for funding their portions of the IVTS Management Group's overall program.

4- The Air Force should begin to bring IVTS into ECI training for other AFSCs (besides maintenance). We have found a technology which allows people to absorb more material, retain it longer, and do it in less time. That is, quite simply, a better mousetrap. Should the Air Force attempt to do all AFSCs at one time or start immediately? No, we can't afford it. But we can afford to look at what it would cost for full scale implementation, pick the most fertile areas to concentrate on first, and develop a prioritization scheme. It is much easier to get funding when you have a defensible approach and a goal. It may take 10-20 years to accomplish full scale IVTS implementation in all AFSCs, but we will never get there unless we start somewhere.

Is the implementation of IVTS in all specialty training courses offered by ECI likely to be the top Air Force IVTS priority? Definitely not! The top priorities are the ones which the MAJCOMs have jumped into quickly and which were described in Chapter III i.e. systems involving front line airplanes, or in AFCC's case, their one-of-a-kind, mission critical equipment. ECI, however, is the provider of a service, essentially fine tuning and implementing what they are provided by the "functional managers" (overall responsible activity) for the individual AFSCs at the Air Staff. Functional managers are not IVTS experts. They are instead, experts in their individual career field areas, and may have

management responsibility for a career field which cuts across several MAJCOMs. The result is that there's no command advocate for developing an IVTS for the AFSC, and command advocacy (as seen in Chapter III) was the only way IVTS got implemented. The Air Staff IVD Management Group would help in providing visibility for and guidance to this effort.

MAJCOM Recommendations

Although the key to the successful "institutionalization" of IVTS lies at the Air Staff, there are some important actions which can be performed at the MAJCOM level which can help.

1-Keep existing IVTS initiatives moving along. The more progress that is being made, the easier IVTS is to "sell" as a concept. Practical demonstrations to senior decision makers while participating in MAJCOM and base level visits, will be particularly valuable.

2-Consolidation of MAJCOM initiatives into a coherent MAJCOM plan for IVTS with a prioritized requirements listing, a price tag attached, and cost/benefit considerations included will make it easier for the Air Staff to help work funding issues. In addition, in looking down the road towards very lean funding years, MAJCOMs must seriously look at potential budget offsets to keep the IVTS wheels in motion. MAJCOMs must form IVTS Management Groups as well, with representation from across the staff and appropriate bases agencies,

to insure all information is pooled and to keep in touch with what other MAJCOMs are doing or planning.

3-Work with bases in their command to develop a base level "picture" of what will be needed in the future at base level to implement an overall IVTS training architecture. Inherent in that process is a discussion of things such as: one large "Base Training Center" versus individual functionally oriented centers; numbers of computers required per number of trainees; and any networking needs which may save money, construction requirements etc.

It is clear that there is a "pearl in the rough" for the Air Force in the way of IVTS for future training enhancements and that, with budget reductions being imminent, the Air Force must increase their emphasis on its exploration and implementation. If they approach this implementation in a logical way and develop an overall Air Force concept and plan, it can be done and done effectively, but it must be started now.

Glossary of Terms

AAC	Alaskan Air Command
AFCC	Air Force Communications Command
AFSC	Air Force Specialty Code
ATC	Air Training Command
CBI	Computer Based Instruction
CBT	Computer Based Training (Umbrella term for CBI, IVD, etc)
CDC	Career Development Course
CD-ROM	Compact Disk-Read Only Memory
CD-I	Compact Disk-Interactive
CGI	Computer Generated Imagery
DVI	Digital Video Interactive
ECI	Extension Course Institute
EIDS	Electronic Information Delivery System
IVD	Interactive Videodisc
IVTS	Interactive Videodisc Training System
MAC	Military Airlift Command
MAJCOM	Major Command
MATAG	Maintenance Training Advisory Group
MTF	Maintenance Training Flight
OJT	On-The-Job Training
PACAF	Pacific Air Forces
PAR	Precision Approach Radar
POM	Program Objective Memorandum
SAC	Strategic Air Command
SSILS	Solid State Instrument Landing System
TAC	Tactical Air Command
TAF	Tactical Air Forces
TOW	Tube Launched Optically Tracked Wire Guided Anti-Tank Missile
USAFE	United States Air Forces in Europe

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